Sunoco, Inc.
3144 Passyunk Avenue
Philadelphia, PA 19145-5299
215 339 2000

HAND DELIVERED

August 30, 2012

Mr. Edward Wiener
Chief, Source Registration
Air Management Services
321 University Avenue
Philadelphia, Pa. 19104

Re: Philadelphia Refinery; Plan Approval Application for Adjustment of Eight Process Heater Firing Limitations With Crude and Product Increases

Dear Mr. Wiener:

Attached please find three copies of a Plan Approval Application and a check for $1000.00 to cover the fee. This application covers adjustment to eight target process heater fuel firing limitations originally set by 25 PA 129.92 (RACT). Emission changes from the firing adjustments and ancillary emissions due to crude processing and product increases are presented. Emission increases are netted to insignificant levels with coincident ERC's from process unit shutdowns at the Marcus Hook Refinery with the result that there are no issues under attainment and non-attainment NSR. Analysis is also presented showing that three small process heaters moved to a rating above 50 MM Btu/Hr do not require controls more stringent than combustion tuning per the original presumptive RACT.

Sunoco will appreciate receiving a letter that the application is administratively complete before the closing of the sale of the refinery to Phila. Energy Solutions Refining and Marketing LLC currently set for September 6, 2012.

Very truly yours,

Charles D. Barksdale, Jr.
Manager, Environmental Department

gcf

File: RACT Adjustment Application & AMS Correspondence 2012

Discussion

Sunoco Philadelphia Refinery
Plan Approval Application for Adjustment of Certain Heater Firing Limitations From 25 PA 129.92 (RACT)

Summary

Sunoco Inc. (R&M) (Sunoco) owns and operates a petroleum refinery in Philadelphia, Pennsylvania. This consists of two processing areas, the Girard Point Processing Area (GP) near the Platt Bridge, and the Point Breeze Processing Area (PB) located near the Passyunk Avenue Bridge. The Philadelphia Sunoco refinery is made up of a number of processing units that are employed in the overall process of converting crude petroleum and other hydrocarbon feed stocks into finished hydrocarbon products and petrochemicals. Products include gasoline, home heating oil, diesel fuel and others. Sunoco also owns the Marcus Hook, Pa Refinery, at which most refining equipment has been shutdown, and application has been made for Emission Reduction Credits.

All of the Philadelphia Refinery processing units rely on the combustion of gaseous fuels (refinery by-product gas and natural gas) in combustion units (direct fired process heaters and steam producing boilers) to provide the energy needed to drive hydrocarbon conversions and product separations. All of the process heaters and boilers have regulatory restraints with the purpose of protecting the environment, including maximum firing limits and limits on the emission rate of key pollutants such as Nitrogen Oxides (NOx). With the shutdown of the Marcus Hook equipment, Sunoco proposes to marginally increase production at the Philadelphia Refinery. By this application Sunoco is proposing to increase the hourly firing limits on eight of its process heaters by an average of 12%. This will allow the refinery to process, on the average, more crude into finished products.

The target heaters proposed for increases are listed as follows:

Process Unit	Heater	Existing Hourly Firing Limit, MM Btu/Hr	Proposed Hourly Firing Limit, MM Btu/Hr
GP Unit 137 Crude	F-1 Crude Heater	415.0	460.0
PB Unit 210 Crude	H101 Crude Heater	183.0	192.0
PB Unit 210 Crude	H-201A/B Crude Heater	242.0	254.0
PB Unit 865 HDS	11H1 Feed Heater	72.2	87.3
PB Unit 865 HDS	11H2 Reboiler Heater	49/9	64.2
PB Unit 866 HDS	12H1 Feed Heater	43.0	61.2
PB Unit 868 FCCU	8H101 Recycle Heater	49.5	60.0
GP Unit 231 HDS	B101 Feed Heater	91.0	104.5

No physical modifications are required for the proposed increases. In addition this application shows that no change is required to existing NOx controls through a RACT analysis per 25 PA 129.92.

By a July 2012 Administrative Amendment the Philadelphia Refinery and the Sunoco Marcus Hook, PA Refinery were determined to be one source.

For the Philadelphia Refinery proposal above, emissions will increase from the reference heaters, as well as from many of the refinery process units. These emissions changes are shown in this application to be netted by Emissions Reduction Credits from the shutdown of certain Sunoco Marcus Hook Refinery units. As a result there are no significant emissions increases pursuant to attainment (PSD) and non-attainment (NANSR) new source review.

Discussion of Emission Increases at Target Process Heaters

Emission increases from the eight target heaters are summarized in an Attachment.

The most important data for the target heaters is the future annual firing rate. All pollutant emission changes refer to the future annual firing rate as compared to the past actual annual firing rate which is calculated from the actual firing in the two most recent years 2010/2011. The future annual firing rate is very conservative and is estimated assuming, for most of the heaters, that the future hourly firing rate will be the old firing hourly limit plus 50% of the increase between the new hourly firing limit and the old hourly firing limit multiplied by the full 8,760 hours in a year. It is extremely unlikely that the refinery could achieve this. Thus, all the emission increases in Table 1 represent the difference between past actual emissions and future projected emissions.

Past actual NOx emissions are based on the historic 2010/2011 actual emissions, adjusted to current permit limits or current realistic emission factors. Future projected NOx emissions are the product of the future annual firing rate as discussed above, and the current realistic or permit limited NOx factor. The NOx increases are therefore the difference between future projected NOx and past actual NOx.

All other target heater pollutant emission changes (VOC etc.) are based on the difference between the future projected annual firing rate and the past actual annual firing rate multiplied by the AP-42 emission factors, except for GHGe which are derived from actual reporting for the target heaters in 2010 and 2011. For a future projected increase in non-GHGe pollutants this is a very appropriate method in that the AP-42 factors are based on 1,020 Btu/cf natural gas. Incremental fuel gas to refinery heaters is mostly natural gas, and even the current refinery fuel gas is very close to natural gas quality.

Discussion of Primary Pollutant Increases at All Sources Except Heaters/Boilers and Target Heaters

See the Attachment. This shows all pollutants except green house gases. The upper left table box shows the expected increases in crude processing related to the target heater increases. The average crude increase (115% of base) is most appropriate for scaling emissions for this category, where scaling is appropriate. Some sources (such as LDAR VOC emissions) are not appropriate for scaling because the emissions of VOC are not rate dependent. The tank VOC emissions are a different exception in that only tank working losses will increase with increased throughput. Typical light hydrocarbon (gasoline) tanks emit 96% through the seals and only 4% of losses is due to throughput. The overall increase factor is therefore 1.006 times base emissions for an average 115% of base product increase (0.96 + 0.04 x 1.15 = 1.006).

Discussion of Primary Pollutant Increases for Non-Targeted Heaters and Boilers

See the Attachment for this set of sources. Future emissions are mostly estimated by ratioing at the average crude increase. The exceptions are for the crude heaters at the crude units experiencing the increases, where the specific crude unit throughput ratios are used.

Discussion of Green House Gases Except at Target Heaters

See the Attachment. All estimates are in metric tons as GHGe. The historic data is from reporting for the years 2010 and 2011. The baseline GHGe are ratioed for crude throughput increases depending on whether the source is a specific crude unit heater, or a source that is affected at the average crude increase. As noted above, LDAR is not rate dependent and will not cause an increase. Also, tank VOC emissions will only increase at the margin due to working loss increases at the factor of 1.006 times the base emission rate.

Summary Emissions Increases and Netting

Refer to the summary and netting Attachment. Here all the sources of emissions increase are summarized and compared to available emission reduction credits from shutdown units at the Sunoco Marcus Hook, Pa Refinery. All pollutant increases are offset (for non-attainment pollutants) or netted to below significance levels for attainment pollutants.

Discussion of Retro RACT Analysis

Please refer to the Appendix. Because no new equipment is being installed, no existing equipment is being physically modified, and neither PSD nor NANSR is being triggered, there are no regulatory reasons to add new controls to the target heaters undergoing firing increases. Three of the target heaters however, are proposed to have new hourly firing limits that put them over the firing capacity for heaters that were determined in 1999 by RACT analysis to be presumptively controlled by combustion tuning rather than physical controls. These heaters are Unit 865 11H2, Unit 866 12H1, and Unit 868 8H101. Some might question whether these heaters unfairly missed an important control analysis. In the Appendix is shown a retro-RACT analysis for each of these heaters, plus, for completeness purposes, for Unit 210 F-1 (large heater) and for 231 B101 and 11H1. As discussed below, there are no heaters that would have been determined to require controls in 1999, other than combustion tuning. Upgrading control efficiencies to today's standards (notably for SCR and ULNB) is shown to not change this conclusion. Obviously, using today's inflated costs would also not change any conclusions.

For the 11H2, 12H1, and 8H101 units, capital costs were developed for the listed control techniques and factored to 1999 values (Nelson-Farrar Inflation Index). O&M costs for 1999 are based on similar sized heater analyses. Control efficiencies of the 1999 period were used, except that for SCR the current efficiency of 85% was substituted. Then a second case was constructed using today's efficiencies and

1999 costs, the most stringent case. One exception from 1999 analysis is that heaters that burned oil in 1999 (11H2, 12H1) were not analyzed with oil in the base emissions. No heater in the Philadelphia Refinery today burns oil. It is assumed that had oil burning elimination been a study case for RACT, that step would have been consider and taken if necessary. In any event that step has positively been taken and is no longer a consideration. In no case is anything other than combustion tuning indicated. Target heaters F-1, 11H1, and B101 were also retro-studied with the same kinds of assumptions. These also show no change of conclusion from 1999. Three heaters were not given the retro-analysis. The Unit 210 H101 heater already had ULNB control in 1999 and it was determined than that SCR and FGR did not physically fit the plot plan, so no other meaningful options existed. Unit 210 H201A/B has NOx control today at a permit limit of 0.03 #/MM Btu, and no further control would be indicated in a retro-analysis.

Proposed Permit Limits

As discussed above there are no changes in this proposal that lead to a new regulatory requirement other than limitations that will assure the basis for the presented emissions changes. All the pollutant increases are netted to below significance by applying select parts of the Marcus Hook Refinery ERC's. The recommendations below are proposed to limit emissions:

- Unit 167 Heater F-1 shall be limited to 460 MM Btu/Hr and 3,767,000 MM Btu on a rolling 365 day basis
- Unit 210 Heater H101 shall be limited to 192 MM Btu/Hr and 1,643,000 MM Btu on a rolling 365 day basis
- Unit 210 Heater 201A/B shall be limited to 254 MM Btu/Hr and 2,120,000 MM Btu on a rolling 365 day basis
- Unit 865 Heater 11H1 shall be limited to 87.3 MM Btu/Hr and 699,000 MM Btu on a rolling 365 day basis
- Unit 865 Heater 11H2 shall be limited to 64.2 MM Btu/Hr and 500,000 MM Btu on a rolling 365 day basis
- Unit 866 Unit Heater 12H1 shall be limited to 61.2 MM Btu/Hr and 456,000 MM Btu on a rolling 365 day basis
- Unit 868 Heater 8H101 shall be limited to 60 MM Btu/Hr and 480,000 MM Btu on a rolling 365 day basis
- Unit 231 Heater B101 shall be limited to 104.5 MM Btu/Hr and 856,000 MM Btu on a rolling 365 day basis
- Unit 127 Crude Unit shall be limited to a crude feed limitation of 200,000 Barrels per Day on a rolling 365 day basis
- Unit 210 Crude Unit shall be limited to a crude feed limitation of 130,000 Barrel per Day on a rolling 365 day basis

ATTACHMENTS

PLAN APPROVAL FORM WITH SIGNATURE

COMPLIANCE HISTORY REVIEW

EMISSIONS AT TARGET HEATERS INCLUDING GHGe

EMISSIONS FOR ALL SOURCES ESCEPT HEATER/BOILER AND TARGET HEATERS

EMISSIONS FOR HEATER/BOILER EXCEPT TARGET HEATERS

GHGe EMISSIONS FOR ALL SOURCES EXCEPT TARGET HEATERS

EMISSIONS SUMMARY AND NETTING

PHILADELPHIA SITE LOCATION MAP

APPENDIX -- NOx Control Effectiveness at New Maximum Firing

CITY OF PHILADELPHIA

DEPARTMENT OF PUBLIC HEALTH
PUBLIC HEALTH SERVICES
AIR MANAGEMENT SERVICES

Air Management Services
321 University Avenue
Philadelphia PA 19104-4543
Phone: (215) 685-7572
FAX: (215) 685-7593

APPLICATION FOR PLAN APPROVAL TO CONSTRUCT, MODIFY OR REACTIVATE AN AIR CONTAMINATION SOURCE AND/OR AIR CLEANING DEVICE

(Prepare all information completely in print or type in triplicate)

SECTION A - APPLICATION INFORMATION

Location of source (Street Address) **3144 Passyunk Avenue**	Facility Name **Philadelphia Facility**	
Owner **Sunoco Inc. (R&M)**		Tax ID No. **23-1743283**
Mailing Address **3144 Passyunk Avenue, Philadelphia, PA 19145**	Telephone No. **(215) 339-2074**	Fax No. **(215) 339-2657**
Contact Person **Charles D. Barksdale**	Title **Manager, Environmental Department**	
Mailing Address **3144 Passyunk Avenue, Philadelphia, PA 19145**	Telephone No. **(215) 339-2074**	Fax No **(215) 339-2657**

SECTION B - DESCRIPTION OF ACTIVITY

Application type ☐New source ☐Modification ☐Replacement ☐Reactivation ☐Air cleaning device ☒Other	SIC Code **2911**	Completion Date **On Approval**
☐ NSPS ☐ NESHAP ☐ Case by Case MACT ☐ NSR ☐ PSD	Does Facility submit Compliance Review Form biannually ? ☒ Yes ☐ No If No attach Air Pollution Control Act Compliance Review Form with this application.	

Source Description: **The Sunoco Philadelphia Refinery proposes to marginally increase the firing limitations of eight process heaters and to raise refinery crude feed and product rates by proportionate amounts. No physical modifications are required to either process units or monitoring systems. Emissions increases will be netted to insignificant levels by the application of coincident ERC's from shutdown units at the Sunoco Marcus Hook, Pa Refinery**

SECTION C - PERMIT COORDINATION (ONLY REQUIRED FOR LAND DEVELOPMENT)

Question	YES	NO
1. Will the project involve construction activity that disturbs five or more acres of land?		X
2. Will the project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system?		X
3. Will the project involve the construction and operation of industrial waste treatment facility?		X
4. Is onsite sewage disposal proposed for your project?		X
5. Will the project involve construction of sewage treatment facilities, sanitary sewer, or sewage pumping station?		X
6. Is a stormwater collection and discharge system proposed for this project?		X
7. Will any work associated with this project take place in or near a stream, waterway, or wetland?		X
8. Does the project involve dredging or construction of any dam, pier, bridge or outfall pipe?		X
9. Will any solid waste or liquid wastes be generated as a result of the project?		X
10. Is a State Park located within two miles from your project?		X

SECTION D – CERTIFICATION

I certify that I have the authority to submit this Permit Application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

Signature _____ Date _____ Address **3144 Passyunk Avenue, Philadelphia, PA 19145**

Name & Title James A. Keeler, Facility Manager Phone **(215) 339-7414** Fax **(215) 339-2657**

SECTION E - OFFICIAL USE ONLY

Application No.	Plant ID	Health District	Census Tract	Fee	Date Received

Approved by	Date	Conformance by	Date

SECTION F 1 - GENERAL SOURCE INFORMATION

1. SOURCE

2. NORMAL PROCESS OPERATING SCHEDULE

	A. Type Source (Describe)	B. Manufacturer of Source	C. Model No.	D. Rated Capacity (Specify units)	E. Type of Materials Processed	A. Amount Processed/yr. (Specify units)	B. Average hr/day	C. Total hr/yr	D. % Throughput/Quarter			
									1st	2nd	3rd	4th
1	**Eight targeted heaters**											
	See Attached Discussion for											
	Proposed Heater Firing											
	Changes Without Physical											
	Changes											

3. ESTIMATED FUEL USAGE (Specify Units)

4. ANNUAL FUEL USAGE

A. Used in Unit	B. Type Fuel	C. Average Hourly Rate	D. Maximum Hourly Rate	E. Percent Sulfur	F. Percent Ash	G. Heating Value	A. Annual Amounts	B. Average hr/day	C. Total hr/yr	D. % Throughput/Quarter			
										1st	2nd	3rd	4th
	See Attached Discussion for												
	Proposed Fired Htr. Duty												
	Changes												

5. IMPORTANT: **Attach on a separate sheet a flow diagram of process giving all (gaseous, liquid, and solid) flow rates . Also list raw materials charged to process equipment and the amounts charged (tons/hour, etc.) at rated capacity (give maximum, minimum and average charges describing fully expected variations in production rates). Indicate (on diagram) all points where contaminants are controlled (location of water sprays, hoods or other pickup points, etc.).**

SECTION F 1 - GENERAL SOURCE INFORMATION, CONTINUED
6. Describe process equipments in detail. **See Attached Diacussion Sections**
7. Describe fully the methods used to monitor and record all operating conditions that may affect the emission of air contaminants. Provide detailed information to show that these methods provided are adequate. **No New Monitoring Equipment is Proposed or Required**
8. Describe modifications to process equipments in detail. **See Attached Discussion Sections – No Physical Changes are Proposed or Required**
9. Attach any and all additional information necessary to adequately describe the process equipment and to perform a thorough evaluation of the extent and nature of its emissions. **See Attached Discussion and the Retro-RACT analysis in the Appendix**

- PROVIDE EQUIPMENT INFORMATION ON THIS PAGE IF SOURCES DO NOT BELONG TO SPECIAL CATEGORIES IN F2 TO F8, OTHERWISE REMOVE THIS PAGE FROM THIS APPLICATION.
- IF THERE ARE MORE EQUIPMENT, COPY THIS PAGE AND FILL IN THE INFORMATION AS INDICATED

SECTION F 2 - COMBUSTION UNITS INFORMATION

1. COMBUSTION UNITS **F-1; H101; H201A/B; 11H1; 11H2; 12H1; 8H101; B101 – See Discussion Sections**

A. Manufacturer **NA**	B. Model No. **NA**	C. Unit No. **NA**
D. Rated heat input (Btu/hr) **NA**	E. Peak heat input (Btu/hr) **NA**	F. Use **NA**

G. Method firing

☐ Pulverized ☐ Spreader Stoker ☐ Cyclone ☐ Tangential ☐ Normal ☐ Fluidized bed ☐ Other _____

2. FUEL REQUIREMENTS

TYPE	*QUANTITY HOURLY*	*QUANTITY ANNUALLY*	*SULFUR*	*ASH*	*BTU CONTENT*
OIL NUMBER **NA**	**NA**	**NA**	**NA**	**NA**	**NA**
OTHER **NA**	**NA**	**NA**	**NA**	**NA**	**NA**

3. COMBUSTION AIDS, CONTROLS, AND MONITORS -- **(No New Equipment)**

☐ A. Overfire jets	Type	Number	Height above grate
☐ B. Draft controls	Type	Type	
☐ C. Oil preheat			
☐ D. Soot cleaning	Temperature (°F)	Frequency	
☐ E. Stack sprays	Method		
☐ F. Opacity monitoring device		Method	Cost
☐ G. Sulfur oxides monitoring device	Type	Method	Cost
☒ H. Nitrogen oxides monitoring device	Type	Method	Cost
☒ I. Fuel metering and/or recording devices	Type	Method	Cost
☐ J. Atomization interlocking device	Type	Method	Cost
☐ K. Collected flyash reentrainment preventative device	Type		

☐ L. Modulating controls ☐ Step ☐ Automatic

4. ☐ Flyash reinjection. (Describe operation)
N/A

5. Describe method of supplying make up air to the furnace room.
N/A

- USE THIS PAGE FOR COMBUSTION SOURCE, OTHERWISE REMOVE THIS PAGE FROM THIS APPLICATION.
- IF THERE ARE MORE THAN ONE UNIT, COPY THIS PAGE AND FILL IN THE INFORMATION AS INDICATED

SECTION F 2 - COMBUSTION UNITS INFORMATION, CONTINUED

6. OPERATING SCHEDULE

__ **NA** _____ hours/day _____ **NA** _____ days/week __ **NA** _____ weeks/year

7. SEASONAL PERIODS (MONTHS) **N/A**

Operating using primary fuel _____ Operating using secondary fuel _____

_____ to _____ _____ to _____

Non-operating

_____ to _____

8. If heat input is in excess of 250 x 10^6 Btu/hr., describe fully the methods used to record the following: rate of fuel burned; heating value, sulfur and ash content of fuels; smoke, sulfur oxides and nitrogen oxides emissions; and if electric generating plant, the average electrical output and the minimum and maximum hourly generation rate.

Sunoco will continue to monitor, record, and report with applicable requirements found in the Philadelphia Refinery's existing Title V permit and the Consent Decree

9. Describe modifications to boiler in detail.

No Physical Changes are Proposed or Required

10. Type and method of disposal of all waste materials generated by this boiler.
(Is a Solid Waste Disposal Permit needed? ☐ Yes ☒ No)

11. Briefly describe the method of handling the waste water from this boiler and its associated air pollution control equipment.
(Is a Water quality Management Permit needed? ☐ Yes ☒ No)

12. Attach any and all additional information necessary to perform a thorough evaluation of this boiler.

See attached Discussion Sections.

- USE THIS PAGE FOR COMBUSTION SOURCE, OTHERWISE REMOVE THIS PAGE FROM THIS APPLICATION.
- IF THERE ARE MORE THAN ONE UNIT, COPY THIS PAGE AND FILL IN THE INFORMATION AS INDICATED

SECTION G - FLUE AND AIR CONTAMINANT EMISSION INFORMATION

1. STACK AND EXHAUSTER

This project does not involve any changes to existing stacks or emission points.

A. Outlet volume of exhaust gases	B, Exhauster (attach fan curves)
_____ CFM @_____ °F _____ % Moisture	_____ in w.g. _____ HP @ _____ RPM

C . Stack height above grade (ft) _____ Grade elevation (ft) _____ Distance from discharge to nearest property line(ft) _____	D Stack diameter (ft) or Outlet duct area (sq. ft.)	E Weather Cap ☐ YES ☐ NO

F. Indicate on an attached sheet the location of sampling ports with respect to exhaust fan, breeching, etc. Give all necessary dimensions.

2 POTENTIAL PROCESS EMISSIONS (OUTLET FROM PROCESS, BEFORE ANY CONTROL EQUIPMENT)

See the Attached Discussion Sections

A. Particulate loading (lbs/hr or gr/DSCF)	B. Specific gravity of particulate (not bulk density)	C . Attached particle size distribution information

D. Specify gaseous contaminants and concentration

Contaminant		Concentration		VOC Contaminants		Concentration	
(1)	SO_x	_____ ppm (Vol.)	_____ lbs/hr	(4)	_____	_____ ppm (Vol.)	_____ lbs/hr
(2)	NO_x	_____ ppm (Vol.)	_____ lbs/hr	(5)	_____	_____ ppm (Vol.)	_____ lbs/hr
(3)	CO	_____ ppm (Vol.)	_____ lbs/hr	(6)	_____	_____ ppm (Vol.)	_____ lbs/hr

E. Does process vent through the control device ? ☐ YES ☐ NO

- If YES continue and fill out the appropriate SECTION H - CONTROL EQUIPMENT
- If NO skip to SECTION I - MISCELLANEOUS INFORMATION

F. Can the control equipment be bypassed: (If Yes, explain) ☐ YES ☐ NO

3. ATMOSPHERIC EMISSIONS

A. Particulate matter emissions (tons per year)

See the Attached Discussion Sections

B. Gaseous contaminant emissions

Contaminants	Concentration		VOC Contaminants	Concentration
(1)	_____ (tpy)	(4)	_____	_____ (tpy)
(2)	_____ (tpy)	(5)	_____	_____ (tpy)
(3)	_____ (tpy)	(6)	_____	_____ (tpy)

See the Attached Discussion Sections

SECTION H - CONTROL EQUIPMENT, CONTINUED

12. COSTS – **See the attached report – No New Equipment**

A. List costs associated with control equipment. (List individual controls separately)

Control Equipment Cost:
Direct Cost:

Indirect Cost:

B. Estimated annual operating costs of control equipment only.

13. Describe modifications to control equipment in detail.

N/A

14. Describe in detail the method of dust removal from the air cleaning and methods of controlling fugitive emissions from dust removal, handling and disposal.

N/A

15. Does air cleaning device employ hopper heaters, hopper vibrators or hopper level detectors? If so, describe.

N/A

16. Attach manufacturer's performance guarantees and/or warranties for each of the major components of the control system (or complete system).

17. Attach the maintenance schedule for the control equipment and any part of the process equipment that if in disrepair would increase the air contaminant emissions. Periodic maintenance reports are to be submitted to the Department.

Maintenance will continue to be be provided as per the manufacturer's recommendations and the Title V Permit.

18. Attach any and all additional information necessary to thoroughly evaluate the control equipment.

No New Control Equipment

SECTION I - MISCELLANEOUS INFORMATION

1. Specify monitoring and recording devices will be used for monitoring and recording of the emission of air contaminants. Provide detailed information to show that the facilities provided are adequate. Include cost and maintenance information.

☐ Opacity monitoring system	☐ SOx monitoring system	☒ NOx monitoring system
☐ CO monitoring system	☐ CO2 monitoring system	☒ Oxygen monitoring system
☐ HCL monitoring system	☐ TRS monitoring system	☐ H2S monitoring system
☐ Temperature monitoring system	☐ Stack flow monitoring system	☐ Other _____

If checked, provide manufacturer's name, model no. and pertinent technical specifications.

NO CHANGES PROPOSED FROM EXISTING MONITORING, AS OUTLINED IN EXISTING TITLE V PERMIT.

- PROVIDE CONTROL EQUIPMENT INFORMATION ON THIS PAGE IF IT PERTAINS TO THIS APPLICATION, OTHERWISE REMOVE THIS PAGE FROM THE APPLICATION.
- IF THERE ARE MORE OF THE SAME TYPE OF CONTROL EQUIPMENT, COPY THAT PAGE AND FILL IN THE INFORMATION AS INDICATED.
- CONTROL EQUIPMENT CAN BE FOUND FROM A MANUFACTURER CATALOGUE OR VENDORS.

2. Attach Air Pollution Episode Strategy (if applicable)

NA

3. If the source is subject to 25 Pa. Code Subchapter E, New Source Review requirements,

a. Demonstrate the availability of emission offset (if applicable)

b. Provide an analysis of alternate sites, sizes, production processes and environmental control techniques demonstrating that the benefits of the proposed source outweigh the environmental and social costs.

NSR is not applicable; see the attached Discussion Sections.

4. Attach calculations and any additional information necessary to thoroughly evaluate compliance with all the applicable requirements of Article III of the rules and regulations of Philadelphia Air Management, Pennsylvania Department of Environmental Protection and those requirements promulgated by the Administrator of the United States Environmental Protection Agency pursuant to the provisions of the Clean Air Act.

See the attached Discussion Sections.

- PROVIDE CONTROL EQUIPMENT INFORMATION ON THIS PAGE IF IT PERTAINS TO THIS APPLICATION, OTHERWISE REMOVE THIS PAGE FROM THE APPLICATION.
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- CONTROL EQUIPMENT CAN BE FOUND FROM A MANUFACTURER CATALOGUE OR VENDORS.

COMPLIANCE HISTORY REVIEW

The Pa Code 25 Section 127.12 requires either a completed compliance review form, or reference to the most recently submitted forms for facilities submitting a compliance review form on a periodic basis. Sunoco files a compliance review semi-annually per 127.12a(j), and the latest form is sent to the offices of Philadelphia AMS in May and November each year.

EMISSION ESTIMATES FOR TARGET HEATERS WITH PROPOSED INCREASES IN FIRING LIMITS -- INCLUDING GREEN HOUSE GASES

Unit	Heater	Existing RACT MM Btu/Hr	Prop. RACT MM Btu/Hr	Future Actual MM Btu/Year	Nox Factor #/MM Btu	Future Act NOx, tpy	Past Actual NOx, tpy	Past Actual Basis	Nox Increase tpy	VOC Increase tpy	PM (Any) Incr. tpy	CO Increase tpy	SO2 Increase tpy	CO2e Incr Met tpy	Past Actual MM Btu/Yr
137	F-1	415	460	3,767,000	0.123	231.7	194.7	2010/11	37.0	2.1	2.9	32.5	0.2	36218	2,978,968
210	H101	183	192	1,643,000	0.089	73.1	62.1	2010/11	11.0	0.7	0.9	10.2	0.1	11337	1,396,333
210	H201AB	242	254	2,120,000	0.03	31.8	20.1	2010/11	11.8	1.4	1.9	21.4	0.2	23927	1,599,400
865	11H1	72.2	87.3	699,000	0.113	39.5	26.1	2010/11	13.4	0.6	0.9	9.7	0.1	10824	463,490
865	11H2	49.9	64.2	500,000	0.113	28.3	19.5	2010/11	8.8	0.4	0.6	6.4	0.05	7114	345,217
866	12H1	43	61.2	456,000	0.113	25.8	9.1	2010/11	16.7	0.8	1.1	12.1	0.09	13526	161,706
868	8H101	49.5	60	480,000	0.113	27.1	18.2	2010/11	9.0	0.4	0.5	5.9	0.04	6616	336,044
231	B101	91	104.5	856,000	0.122	52.2	28.2	2010/11	24.1	1.1	1.5	16.3	0.1	18156	460,953
									131.7	**7.5**	**10.4**	**114.5**	**0.82**	**127718**	7,742,110

Notes:

Except for F-1, each heater will increase annual Btu by 50% of RACT hour maximum increase over 8760 hrs/yr; F-1 is 33% of hourly increase on an annualized basis.

Unit 137 F-1 is NOx CEM data in this period

Unit 210 H201 has had NOx CEM in use since 4th quarter 2009

231 and 210 H101/H201 emission factors based on permit or RACT limit. Past actual emission estimates revised based on this factor.

865 and 866 heater NOx Emisson Factors based on similar 865 11H1 NOx RACT emission factor

Other Pollutant Factors

	Factor	Units	Source
VOC	0.00539	#/MM Btu	AP-42
PM/PM10/PM2.5 (Total)	0.00745	#/MM Btu	AP-43
CO	0.0824	#/MM Btu	AP-44
SO2	0.00059	#/MM Btu	AP-45
CO2e	0.04596	Met ton/MM Btu	2010/11 Rpts

Crude Increase Basis

Crude Unit	2010-11 ACTUAL	Future Actual RATE	INCREASE
137	166.1	200	120%
210	121.2	130	107%
TOTAL	**287.3**	**330**	**115%**

All Increases (except Tanks) are ratioed from the 115% average factor. See Tank note below.

EMISSION ESTIMATES FOR ALL SOURCES EXCEPT H/B AND TARGET HEATERS WITH INCREASED FIRING LIMITS

SEE SEPARATE TABLE FOR GREEN HOUSE GASES

	2010 ACTUAL EMISSIONS (TPY)					2011 ACTUAL EMISSIONS (TPY)					2010-11 Average ACTUAL EMISSIONS (TPY)					Future Actual EMISSIONS (TPY)				
	VOC	SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM
WWTP	62.6					51.6	-	-	-	-	57.1					65.58	-	-	-	-
LDAR*	176.4					174.48	-	-	-	-	175.44					175.44	-	-	-	-
TANKS	243					159.95	-	-	-	-	201.475					202.67	-	-	-	-
GP BARGE LOADING (MVRU)	8		35.28	2.05	0.32	8.35	-	36.89	2.15	0.32	8.175		36.085	2.1	0.32	9.39	-	41.45	2.41	0.37
PB WHARF	31.5					33.4	-	-	-	-	32.45					37.27	-	-	-	-
GP BUTANE/PP LOADING	1.03					0.95	-	-	-	-	0.99					1.14	-	-	-	-
COOLING TOWERS*	50.18				32.76	50.18	-	-	-	30.82	50.18				31.79	50.18	-	-	-	31.79
FLARES*	36.2	0.215	17.51	95.5		31.78	0.132	15.47	84	-	33.99	0.1735	16.49	89.75		33.99	0.17	16.49	90	-
SAMPLING SYSTEMS*	15.64					15.64	-	-	-	-	15.64					15.64	-	-	-	-
RICE*	19.9	0.08	250.7	54	17.6	38.5	0.15	178.1	125.3	13.98	29.2	0.115	214.4	89.65	15.79	29.20	0.12	214.40	89.65	15.79
SRTF WWTP	0.93					2.29	-	-	-	-	1.61					1.85	-	-	-	-
SRTF LDAR*	22.24					28.37	-	-	-	-	25.305					25.31	-	-	-	-
SRTF TANKS	66.8					68.4	-	-	-	-	67.6					68.00	-	-	-	-
SRTF FLARE*	0.39	0.007	0.19	1.03		0.39	0.00065	0.19	1.03	-	0.39	0.003825	0.19	1.03		0.39	0.00383	0.19	1.03	-
Total						664.3	0.3	230.7	212.5	45.1	699.5	0.3	267.2	182.5	47.9	716.1	0.3	272.5	182.8	47.9

* - emissions not impacted by throughput change

For Tanks working losses are approximately 4% and will increase by throughput change
0.96 + .04*1.15 = 1.006

Note: 868 and 1232 FCCUs are generally operated at optimal rates and feed purchased (or transferred from MH) in 2010-11 will be replaced by increased production at 137 and 210 and should therefore show no significant change in emissions in the future.

Emission Impacts at Unit 867 (SRU)

	2010 Actual Emission (tpy)	2011 Actual Emission (tpy)	2010-11 Average Emissions (tpy)	Future Actual Emissions (tpy)	Actual 2010-11 Avg to Future Actual (tpy)	
Rate (LTPD)	29.2	30.3	29.8	34	4	
SOx	14.1	10.4	12.3	14.07	1.82	
NOx	4.36	2.4	3.4	3.90	0.50	
CO	171	95.0	133.0	152.76	19.76	
PM		-	-	-	-	
VOC		-	-	-	-	-

Per 2010/2011	Ton/LTPD
Sox Ratio	0.4116
Nox Ratio	0.1141
CO Ratio	4.4689
PM Ratio	
VOC Ratio	

Actual 2010 Sulfur Prod.	10668.5 Long Ton
Actual 2011 Sulfur Prod	11057.4 Long Ton

Crude Increase Basis

Crude Unit	2010-11 Average	Future Actual	INCREASE
137	166.1	200	120%
210	121.2	130	107%
TOTAL	**287.3**	**330**	**115%**

EMISSION EST'S FOR H/B EXCEPT TARGET HEATERS WITH INCREASED FIRING LIMITS

SEE SEPARATE TABLE FOR GREEN HOUSE GASES

Future emissions estimates were ratioed as above
137 heaters were rationed at the 137 increase
210 heaters were ratioed at the 210 increase
All other heaters were ratioed based on the average increase

Shaded (blank)are the Target Heaters estimated in the separate RACT limit increase table

Unit	Heater	2010 ACTUAL EMISSIONS (TPY)					2011 ACTUAL EMISSIONS (TPY)					2010-11 Average ACTUAL EMISSIONS (TPY)					Future Actual EMISSIONS (TPY)				
		SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM	VOC	SOX	NOX	CO	PM	VOC
137	F-1																				
	F-2	0.87	48.73	26.70	2.41	1.75	0.97	37.33	24.06	2.18	1.58	0.92	43.03	25.38	2.29	1.67	1.11	51.80	30.56	2.76	2.00
	F-3	0.41	6.91	12.20	1.11	0.80	0.50	6.42	11.61	1.05	0.76	0.45	6.67	11.91	1.08	0.78	0.55	8.02	14.33	1.30	0.94
210	H-101																				
	H-201																				
	13H-1	1.60	87.40	52.40	4.72	3.43	1.23	83.80	50.30	4.55	3.30	1.42	85.60	51.35	4.64	3.37	1.52	91.83	55.08	4.97	3.61
1332	H-400	2.25	15.38	40.1	3.62	2.62	0.45	15.38	46.17	4.18	3.02	1.35	15.38	43.11	3.90	2.82	1.55	17.66	49.52	4.48	3.24
	H-401	2.73	20.72	49.8	4.50	3.26	0.59	20.72	62.19	5.63	4.07	1.66	20.72	55.99	5.07	3.66	1.90	23.80	64.31	5.82	4.21
	H-601	0.43	4.03	6.69	0.61	0.44	0.03	4.78	7.83	0.71	0.51	0.23	4.40	7.26	0.66	0.48	0.26	5.06	8.34	0.75	0.55
	H-602	0.66	7.62	12.8	1.16	0.84	0.16	9.30	15.53	1.41	1.02	0.41	8.46	14.16	1.28	0.93	0.47	9.72	16.26	1.47	1.06
	H-1	0.052237	0.03	0.05	0.00	0.00	0.000003	0.22	0.36	0.03	0.02	0.03	0.12	0.20	0.02	0.01	0.03	0.14	0.23	0.02	0.01
	H-2	0.516526	4.25	1.37	0.98	0.71	0.000000	4.98	1.61	1.19	0.86	0.26	4.61	1.49	1.08	0.78	0.30	5.30	1.71	1.24	0.90
	H-3	0.39	3.88	6.48	0.59	0.42	0.08	5.43	9.03	0.82	0.59	0.24	4.66	7.76	0.70	0.51	0.27	5.35	8.91	0.81	0.58
860	2H2	0.40	8.71	14.32	1.30	0.94	0.65	8.47	12.60	1.14	0.82	0.53	8.59	13.46	1.22	0.88	0.60	9.87	15.46	1.40	1.01
	2H3	1.01	61.55	36.19	3.27	2.37	1.76	64.20	34.00	3.08	2.23	1.38	62.88	35.09	3.18	2.30	1.59	72.22	40.31	3.65	2.64
	2H4	0.52	11.41	18.73	1.69	1.23	0.90	11.70	17.40	1.58	1.14	0.71	11.55	18.07	1.64	1.18	0.81	13.27	20.75	1.88	1.36
	2H5	1.13	69.59	40.83	3.69	2.67	1.81	65.70	34.90	3.16	2.28	1.47	67.65	37.86	3.43	2.48	1.69	77.70	43.49	3.93	2.84
	2H7	0.42	9.24	15.23	1.38	1.00	0.64	8.31	12.40	1.12	0.81	0.53	8.77	13.81	1.25	0.90	0.61	10.08	15.87	1.43	1.04
	2H8	0.01	7.80	12.59	1.14	0.82	0.03	6.92	11.10	1.01	0.73	0.02	7.36	11.85	1.07	0.78	0.02	8.45	13.61	1.23	0.89
864	PH1	0.45	9.17	14.84	1.34	0.97	0.14	8.02	13.70	1.24	0.90	0.29	8.59	14.27	1.29	0.94	0.34	9.87	16.39	1.48	1.07
	PH7	0.23	4.70	7.62	0.69	0.50	0.07	4.49	7.71	0.70	0.51	0.15	4.60	7.66	0.69	0.50	0.17	5.28	8.80	0.80	0.58
	PH11	0.44	8.91	14.44	1.31	0.95	0.12	7.44	12.80	1.16	0.84	0.28	8.18	13.62	1.23	0.89	0.32	9.39	15.64	1.41	1.02
	PH12	0.37	7.59	12.29	1.11	0.80	0.13	6.61	11.40	1.03	0.74	0.25	7.10	11.84	1.07	0.77	0.29	8.15	13.60	1.23	0.89
859	1H1	0.90	6.98	9.98	2.48	1.81	0.79	5.44	7.77	2.07	1.49	0.84	6.21	8.88	2.27	1.65	0.97	7.13	10.19	2.61	1.90
865	11H1																				
	11H2																				
866	12H1																				
868	8H101																				
870	H-01	0.05	4.09	5.29	3.52	0.06	0.11	4.07	0.03	0.88	0.06	0.08	4.08	2.66	2.20	0.06	0.09	4.69	3.05	2.53	0.06
433	H-1	2.43	7.97	42.40	3.83	2.77	0.25	14.98	55.66	5.04	3.64	1.34	11.48	49.03	4.43	3.21	1.54	13.18	56.32	5.09	3.68
231	H-101																				
1232	B-104	0.01	0.29	0.45	0.04	0.03	0.07	0.99	1.69	0.15	0.11	0.04	0.64	1.07	0.10	0.07	0.05	0.73	1.23	0.11	0.08
870	H-02	0.23	4.22	0.082	1.528	0.139	0.36	3.63	0.03	0.329	0.12	0.295	3.925	0.056	0.9285	0.1295	0.34	4.51	0.06	1.07	0.15
HTR	Total	18.50	421.16	453.79	48.03	31.33	11.83	409.32	461.88	45.40	32.15	15.17	415.24	457.84	46.71	31.74	17.39	473.19	524.03	53.49	36.33
																	2.22	57.95	66.19	6.78	4.60
	3BH	12.91	199.60	316.24	36.96	20.69	21.80	156.50	330.40	29.90	21.60	17.36	178.05	323.32	33.43	21.15	19.93	204.51	371.36	38.40	24.29

2010 PM emissions revised based on new factor used in 2011

total steam made in 2011: 6200 MMlbs

	Htr/boil	31.41	620.76	770.03	84.99	52.02	33.63	565.82	792.28	75.30	53.75	32.52	593.29	781.16	80.14	52.88	37.32	677.70	895.39	91.88	60.62

Crude Increase Basis

CRUDE UNIT	2010 ACTUAL RATE (MBPD)	2011 ACTUAL RATE (MBPD)	2010/2011 Averge Rate (MBPD)	Future Actual RATE (MBPD)	INCREASE
137	173.4	158.8	166.1	200	120%
210	128.3	114.1	121.2	130	107%
TOTAL		**272.9**	**287.31**	**330**	**115%**

GREEN HOUSE GAS EMISSIONS FOR ALL SOURCES EXCEPT TARGET HEATERS WITH INCREASED FIRING LIMITS - SEE SEPARATE TABLE

Future emissions estimates were ratioed as follows:

137 heaters (non-targeted) were rationed at the 137 increase

210 heaters (non0targeted) were ratioed at the 210 increase

All other (non-targeted) htrs/blr/Other are ratioed on the avg. ex LDAR and Tanks

Target Adjusted Heaters are covered in a separate calculation table

All Values are GHGe in Metric Tons

	GHGe Report 2010	GHGe Report 2011	GHGe Average 2010/2011	Future Actual Estimate	
137 Unit Except F-1	50627	44637	47632	57345	
210 Unit Except H101 & H201A/B	90715	76739	83727	89816	
All Other (non-targeted) H/B	1054333	1056280	1055307	1212108	
Non-Target H/B Sum			**1186666**	**1359269**	
Unit 867 SRU	16773	19255	**18014**	**20691**	
Gir. Point MVRU	19748	19748	19748	22682	
All LDAR	496	496	496	496	No increase in VOC
All Tks	259	249	254	256	1.006 factor at 115% base crude increase
All Flares	45068	17138	31103	31103	
Non-H/B, Non-SRU Other Sum			**51601**	**54537**	

Sulfur Plant Impacts

	2010/2011 Actual		Future Actual	Increase (Future Act - 2010/11 Act)	
SO2	12.3		14.1	1.8	
Nox	3.4		3.9	0.5	
PM					
CO	133.0		152.8	19.8	
VOC					
GHGe	18014		20691	2676.6	

SUMMARY OF ALL EMISSIONS AND NETTING OF INCREASES

Emission impacts - all sources except Heater/Boilers and Sulfur Plant

	2010/2011 Actual		Future Actual	Increase (Future Act - 2010/11 Act)	
SO2	0.3		0.3	0.0	
Nox	267.2		272.5	5.4	
PM	47.9		47.9	0.0	
CO	182.5		182.8	0.3	
VOC	699.5		716.1	16.5	
GHGe	51601		54537	2935.8	

Heater/boiler impacts from rate changes (excluding heater w/increased NOX RACT limits)

	2010/11 Actual		Future Actual	Increase (Future Act - 2010/11 Act)	
SO2	32.52		37.32	4.8	
Nox	593.29		677.70	84.4	
PM	80.14		91.88	11.7	
CO	781.16		895.39	114.2	
VOC	52.88		60.62	7.7	
GHG	1186666		1359269	172603.9	

CRUDE INCREASE BASIS

CRUDE UNIT	2010 ACTUAL RATE (MBPD)	2011 ACTUAL RATE (MBPD)	2010/2011 Averge Rate (MBPD)	Future Actual RATE (MBPD)	INCREASE
137	173.4	158.8	166.1	200	120%
210	128.3	114.1	121.2	130	107%
TOTAL		**272.9**	**287.31**	**330**	**115%**

Summary of above emissons increases (excludes direct RACT heater change impacts)

	2010/11 Actual		Future Actual	Increase (Future Act - 2010/11 Act)	
SO2	45.1		51.7	6.6	
Nox	863.8		954.1	90.3	
PM	128.0		139.8	11.8	
CO	1096.7		1231.0	134.3	
VOC	752.4		776.7	24.2	
GHG				178216.3	

Nox RACT Impacts

				Increase (Future Act - 2010/11 Act)	
SO2				0.8	
Nox				131.7	
PM				10.4	
CO				114.5	
VOC				7.5	
GHGe				127718	

Total Increases

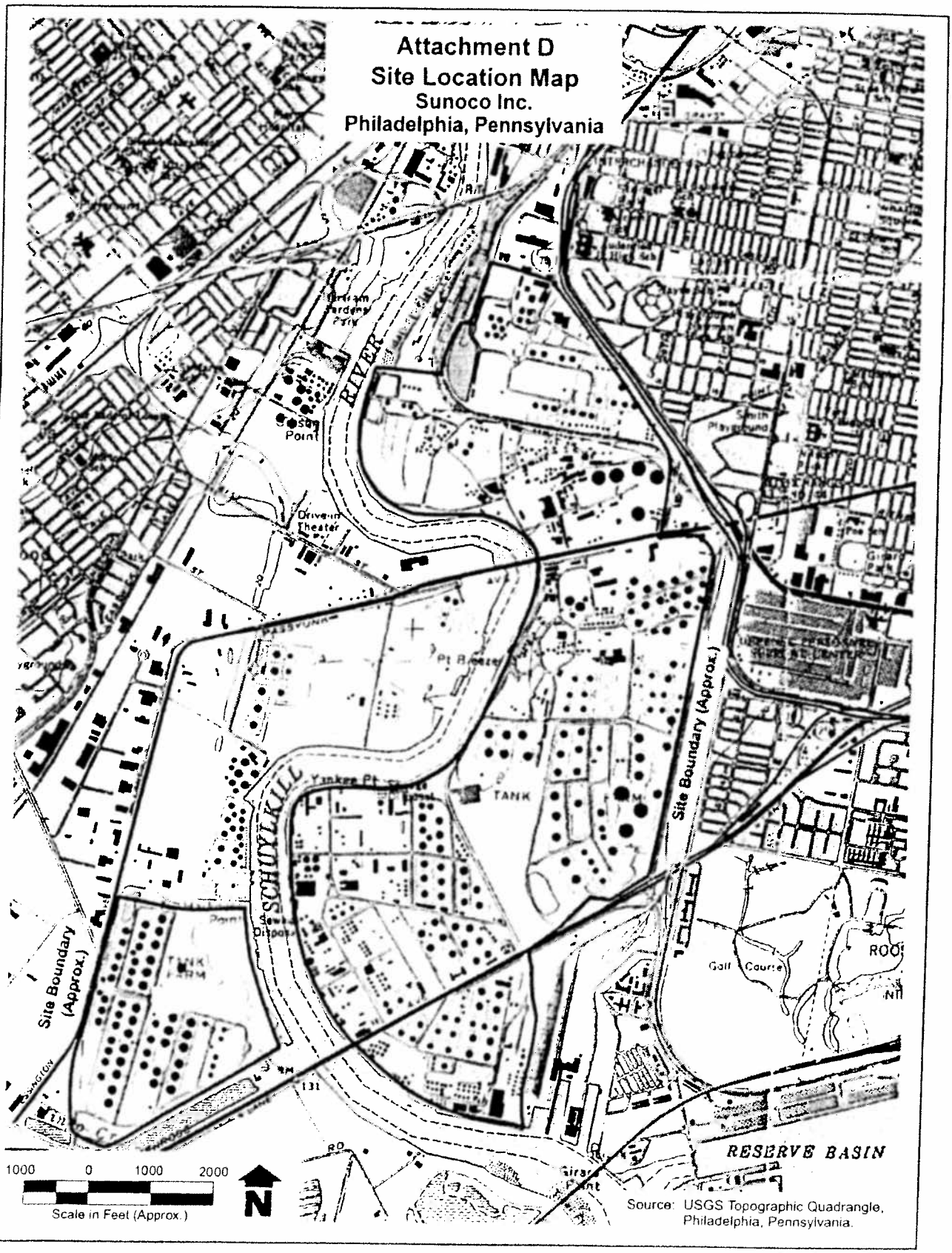
				Increase (Future Act - 2010/2011 Act)	
SO2				7.4	
Nox				222.0	
PM				22.2	
CO				248.8	
VOC				31.7	
GHGe				305934.3	

NETTING

Philadelphia Refinery Needs

	Nox	SO2	VOC	CO	PM	Metric CO2e
Nox RACT	**131.7**	**0.8**	**7.5**	**114.5**	**10.4**	**127,718**
22 BH#2	**-17.875**	**-0.70**	**-0.54**	**-0.15**	**0.76**	**45,167**
12-3 CRUDE HTR H-3006	**-89.5**	**-0.13**	**-4.6**	**-70.37**	**6.36**	**83,538**
17-2A H-01, H-02, H-03 HTR	**-57.04**	**-0.05**	**-2.72**	**-41.2**	**3.8**	**40,744**
12-3 CRUDE DESULF HTR	**-6.1**	**-0.01**	**-0.3**	**-5.1**	**0.5**	**4,372**
Net Amount needed	**-38.78**	**-0.07**	**-0.66**	**-2.30**	**-0.95**	**-10425**
Indirect Emissions	**90.3**	**6.6**	**24.2**	**134.3**	**11.8**	**178,216**
15-1 Crude Heater	**-136.5**	**-0.15**	**-5.1**	**-77.2**	**-7.0**	**-100,791**
17-2A H-04 HTR	**-6.2**	**-0.01**	**-0.4**	**-5.2**	**-0.5**	**-7,485**
MH Cooling Towers			**-19.9**		**-10.2**	
Net amount with Indirect	**-91.2**	**6.4**	**-1.8**	**49.6**	**-6.9**	**59515**
						65604

short ton


Attachment D
Site Location Map
Sunoco Inc.
Philadelphia, Pennsylvania
RIVER
SCHUYLKILL
Site Boundary (Approx.)
Site Boundary (Approx.)
TANK
RESERVE BASIN
Golf Course
1000 0 1000 2000
Scale in Feet (Approx.)
N
Source: USGS Topographic Quadrangle, Philadelphia, Pennsylvania.

APPENDIX

RETRO RACT EVALUATION

TARGET HEATERS FOR FIRING LIMIT ADJUSTMENT

NOX CONTROL EFFECTIVENESS AT NEW MAXIMUM FIRING

Nox Control Cost Effectiveness at Max Capacity

Source B101 Heater at Unit 231

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Original and Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	Ref. 1999 Total Capital Cost $	Ref. 1999 O & M Cost $	Ref 1999 Annualized Cost $	1999 PTE Cost Effectiveness
LNB & SCR	**104.5**	0.122	**55.8**	NA	87	**7.3**	**48.6**	1,684,000	50,513	348,581	7,175
LNB & SNCR	**104.5**	0.122	**55.8**	NA	80	**11.2**	**44.7**	904,000	27,124	187,132	4,189
SCR	**104.5**	0.122	**55.8**	NA	**85**	**8.4**	**47.5**	**1,368,000**	10,761	252,897	5,328
ULNB	**104.5**	0.122	**55.8**	NA	47	**29.6**	**26.2**	356,000	10,680	73,692	2,808
SNCR	**104.5**	0.122	**55.8**	NA	40	**33.5**	**22.3**	543,000	16,286	112,397	5,032
LNB & FGR	**104.5**	0.122	**55.8**	NA	55	**25.1**	**30.7**	428,000	12,850	88,606	2,885
CT	**104.5**	0.122	**55.8**	NA	15	**47.5**	**8.4**	-	7000	7,000	836

None in 1999

Adj SCR to Realistic

Nox Control Cost Effectiveness at Max Capacity

Source B101 Heater at Unit 231

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Original and Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	Ref. 1999 Total Capital Cost $	Ref. 1999 O & M Cost $	Ref 1999 Annualized Cost $	1999 PTE Cost Effectiveness
LNB & SCR	**104.5**	0.122	**55.8**	NA	87	**7.3**	**48.6**	1,684,000	50,513	348,581	7,175
LNB & SNCR	**104.5**	0.122	**55.8**	NA	80	**11.2**	**44.7**	904,000	27,124	187,132	4,189
SCR	**104.5**	0.122	**55.8**	NA	**85**	**8.4**	**47.5**	**1,368,000**	10,761	252,897	5,328
ULNB	**104.5**	0.122	**55.8**	NA	47	**29.6**	**26.2**	356,000	10,680	73,692	2,808
SNCR	**104.5**	0.122	**55.8**	NA	40	**33.5**	**22.3**	543,000	16,286	112,397	5,032
LNB & FGR	**104.5**	0.122	**55.8**	NA	55	**25.1**	**30.7**	428,000	12,850	88,606	2,885
CT	**104.5**	0.122	**55.8**	NA	15	**47.5**	**8.4**	-	7000	7,000	836

None in 1999

Adj SCR to Realistic

Nox Control Cost Effectiveness at Max Capacity
Source B101 Heater at Unit 231

Evaluated at New Firing Limit but at 1999 Cost and 2012 Efficiencies
Most Stringent Case

Control Option	New Rating MM Btu/Hr Maximum	Original and Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	Ref. 1999 Total Capital Cost $	Ref. 1999 O & M Cost $	Ref 1999 Annualized Cost $	1999 PTE Cost Effectiveness
ULNB & SCR	**104.5**	0.122	**55.8**	NA	**96**	**2.2**	**53.6**	1,684,000	50,513	348,581	6,503
ULNB & SNCR	**104.5**	0.122	**55.8**	NA	**53**	**26.2**	**29.6**	904,000	27,124	187,132	6,323
SCR	**104.5**	0.122	**55.8**	NA	**85**	**8.4**	**47.5**	**1,368,000**	10,761	252,897	5,328
ULNB	**104.5**	0.122	**55.8**	NA	**76**	**13.4**	**42.4**	356,000	10,680	73,692	1,736
SNCR	**104.5**	0.122	**55.8**	NA	**40**	**33.5**	**22.3**	543,000	16,286	112,397	5,032
LNB & FGR	**104.5**	0.122	**55.8**	NA	**55**	**25.1**	**30.7**	428,000	12,850	88,606	2,885
CT	**104.5**	0.122	**55.8**	NA	**10**	**50.3**	**5.6**	-	7000	7,000	1,254
				None in 1999							

Source	*2012 Eff.*	*Comment*
ULNB & SCR	95	Combining both removal Effs
ULNB & SNCR	53	Combining both removal Effs
SCR	85	Based on 1332 Performance
ULNB	76	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	55	LNB removal Eff. alone is 21%; Neither LNB nor FGR is used on heaters in USA Today
CT	10	Basic
LNB	NA	Would not install vs ULNB

Nox Control Cost Effectiveness at Max Cpacity

Source 11H2 Heater at Unit 865

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
LNB & SCR	**64.2**	0.113	31.8	NA	87	4.1	27.6	**2291000**	40400	445,907	**16,130**
LNB & SNCR	**64.2**	0.113	31.8	NA	80	6.4	25.4	**957000**	22000	191,389	**7,529**
SCR	**64.2**	0.113	31.8	NA	**85**	4.8	27.0	**1904000**	40400	377,408	**13,973**
ULNB	**64.2**	0.113	31.8	NA	47	16.8	14.9	**262000**	8500	54,874	**3,674**
SNCR	**64.2**	0.113	31.8	NA	40	19.1	12.7	**723000**	13000	140,971	**11,091**
LNB & FGR	**64.2**	0.113	31.8	NA	55	14.3	17.5	**947000**	10300	177,919	**10,181**
CT	**64.2**	0.113	31.8	NA	15	27.0	4.8	**0**	7000	7,000	**1,469**

SCR Adj
to Realistic

Nox Control Cost Effectiveness at Max Cpacity

Source 11H2 Heater at Unit 865

Evaluated at New Firing Limit, 1999 Cost, and 2012 Efficiencies
Most Stringent Case

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	**1999** Total Capital Cost $	**1999** O & M Cost $	**1999** Annualized Cost $	**1999** PTE Avg. Cost Effectiveness $/Ton
ULNB & SCR	**64.2**	0.113	31.8	NA	**96**	1.3	30.5	**2291000**	**40400**	445,907	**14,618**
ULNB & SNCR	**64.2**	0.113	31.8	NA	**53**	14.9	16.8	**957000**	**22000**	191,389	**11,365**
SCR	**64.2**	0.113	31.8	NA	**85**	4.8	27.0	**1904000**	**40400**	377,408	**13,973**
ULNB	**64.2**	0.113	31.8	NA	**74**	8.3	23.5	**262000**	**8500**	54,874	**2,334**
SNCR	**64.2**	0.113	31.8	NA	**40**	19.1	12.7	**723000**	**13000**	140,971	**11,091**
LNB & FGR	**64.2**	0.113	31.8	NA	**NA**	NA	NA	**NA**	**NA**	**NA**	**NA**
CT	**64.2**	0.113	31.8	NA	**15**	27.0	4.8	**0.0**	7000.0	7,000	**1,469**

Source	*2012 Eff.*	*Comment*
ULNB & SCR	96	Combining both removal Effs; **ULNB** for LNB
ULNB & SNCR	53	Combining both removal Effs; **ULNB** for LNB
SCR	85	Based on Unit 1332 Performance
ULNB	74	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	NA	**Neither LNB nor FGR is used on heaters in USA today; eff. not changed from base also**
CT	10	Basic
LNB	15	Would not install vs ULNB

Nox Control Cost Effectiveness at Max Cpacity

Source 12H1 Heater at Unit 866

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
LNB & SCR	**61.2**	0.113	30.3	NA	87	3.9	26.4	2195000	40400	428,915	16,276
LNB & SNCR	**61.2**	0.113	30.3	NA	80	6.1	24.2	912000	22000	183,424	7,569
SCR	**61.2**	0.113	30.3	NA	**85**	4.5	25.7	1826000	40400	363,602	14,122
ULNB	**61.2**	0.113	30.3	NA	47	16.1	14.2	250000	8500	52,750	3,705
SNCR	**61.2**	0.113	30.3	NA	40	18.2	12.1	690000	13000	135,130	11,153
LNB & FGR	**61.2**	0.113	30.3	NA	55	13.6	16.7	913000	10300	171,901	10,318
CT	**61.2**	0.113	30.3	NA	15	25.7	4.5	0	7000	7,000	1,541

Adj SCR to Realistic

Nox Control Cost Effectiveness at Max Cpacity
Source 12H1 Heater at Unit 866

Evaluated at New Firing Limit but at 1999 Cost and 2012 Efficiencies

Most Stringent Case

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont **Eff** % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
ULNB & SCR	**61.2**	0.113	30.3	NA	**96**	1.2	29.1	**2195000**	40400	428,915	**14,750**
ULNB & SNCR	**61.2**	0.113	30.3	NA	**53**	14.2	16.1	**912000**	22000	183,424	**11,426**
SCR	**61.2**	0.113	30.3	NA	**85**	4.5	25.7	**1826000**	40400	363,602	**14,122**
ULNB	**61.2**	0.113	30.3	NA	**74**	7.9	22.4	**250000**	8500	52,750	**2,353**
SNCR	**61.2**	0.113	30.3	NA	**40**	18.2	12.1	**690000**	13000	135,130	**11,153**
LNB & FGR	**61.2**	0.113	30.3	NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
CT	**61.2**	0.113	30.3	NA	**15**	25.7	4.5	**0**	7000	7,000	**1,541**

Source	*2012 Eff.*	*Comment*
ULNB & SCR	96	Combining both removal Effs; **ULNB** for LNB
ULNB & SNCR	53	Combining both removal Effs; **ULNB** for LNB
SCR	85	Based on Unit 1332 Performance
ULNB	74	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	NA	**Neither LNB nor FGR is used on heaters in USA today; eff. not changed from base also**
CT	10	Nbasic
LNB	15	Would not install vs ULNB

Cap Recv'y at 10 Yr and 12% is 0.177

Nox Control Cost Effectiveness at Max Cpacity

Source 8H101 Heater at Unit 868

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
LNB & SCR	**60**	0.113	29.7	NA	87	3.9	25.8	1929000	40400	381,833	14,779
LNB & SNCR	**60**	0.113	29.7	NA	80	5.9	23.8	895000	22000	180,415	7,594
SCR	**60**	0.113	29.7	NA	**85**	4.5	25.2	1567000	40400	317,759	12,589
ULNB	**60**	0.113	29.7	NA	47	15.7	14.0	245000	8500	51,865	3,716
SNCR	**60**	0.113	29.7	NA	40	17.8	11.9	676000	13000	132,652	11,167
LNB & FGR	**60**	0.113	29.7	NA	55	13.4	16.3	672000	10300	129,244	7,913
CT	**60**	0.113	29.7	NA	15	25.2	4.5	0	7000	7,000	1,571

None in 1999 — Adj SCR to realistic

Nox Control Cost Effectiveness at Max Cpacity

Source 8H101 Heater at Unit 868

Evaluated at New Firing Limit but at 1999 Cost and 2012 Efficiencies

Most Stringent Case

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
ULNB & SCR	**60**	0.113	29.7	NA	**96**	1.2	28.5	**1929000**	40400	381,833	**13,394**
ULNB & SNCR	**60**	0.113	29.7	NA	**53**	14.0	15.7	**895000**	22000	180,415	**11,463**
SCR	**60**	0.113	29.7	NA	**85**	4.5	25.2	**1567000**	40400	317,759	**12,589**
ULNB	**60**	0.113	29.7	NA	**74**	7.7	22.0	**245000**	8500	51,865	**2,360**
SNCR	**60**	0.113	29.7	NA	**40**	17.8	11.9	**676000**	13000	132,652	**11,167**
LNB & FGR	**60**	0.113	29.7	NA	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
CT	**60**	0.113	29.7	NA	**15**	25.2	4.5	**0**	7000	7,000	**1,571**

None in 1999

Source	*2012 Eff.*	*Comment*
ULNB & SCR	96	Combining both removal Effs; **ULNB** for LNB
ULNB & SNCR	53	Combining both removal Effs; **ULNB** for LNB
SCR	85	Based on Unit 1332 Performance
ULNB	74	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	NA	**Neither LNB nor FGR is used on heaters in USA today; eff. not changed from base also**
CT	10	Minimial to gain here
LNB	15	Would not install vs ULNB

Nox Control Cost Effectiveness at Max Cpacity

Source F-1 Heater at Unit 137

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Incr. Shdn. Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
LNB & SCR	**460**	0.123	247.8	NA	87	32.2	215.6	6626987	382405	3942120	2,253,137	10,450
LNB & SNCR	**460**	0.123	247.8	NA	68	79.3	168.5	1027691	179888	3942120	1,059,545	6,287
SCR	**460**	0.123	247.8	NA	**85**	37.2	210.6	5141215	341546	0	1,251,541	5,941
ULNB	**460**	0.123	247.8	NA	47	131.3	116.5	1634182	44940	3942120	1,031,945	8,860
SNCR	**460**	0.123	247.8	NA	40	148.7	99.1	2541919	139029	0	588,949	5,941
LNB & FGR	**460**	0.123	247.8	NA	55	111.5	136.3	1875511	76377	3942120	1,106,098	8,115
CT	**460**	0.123	247.8	NA	15	210.6	37.2	0	7000	0	7,000	188

None in 1999

Adj SCR to Realistic

Nox Control Cost Effectiveness at Max Cpacity

Source F-1 Heater at Unit 137

Evaluated at New Firing Limit but at 1999 Cost and 2012 Efficiencies

Most stringent case

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Incr. Shdn. Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
ULNB & SCR	**460**	0.123	247.8	NA	**96**	9.9	237.9	6626987	382405	3942120	2,253,137	9,471
ULNB & SNCR	**460**	0.123	247.8	NA	**53**	116.5	131.3	1027691	179888	3942120	1,059,545	8,067
SCR	**460**	0.123	247.8	NA	**85**	37.2	210.6	5141215	341546	0	1,251,541	5,941
ULNB	**460**	0.123	247.8	NA	**76**	59.5	188.3	1634182	44940	3942120	1,031,945	5,479
SNCR	**460**	0.123	247.8	NA	**40**	148.7	99.1	2541919	139029	0	588,949	5,941
LNB & FGR	**460**	0.123	247.8	NA	**55**	111.5	136.3	1875511	76377	3942120	1,106,098	8,115
CT	**460**	0.123	247.8	NA	**15**	210.6	37.2	0	7000	0	7,000	188

None in 1999 — Adj SCR to Realistic

Source	*2012 Eff.*	*Comment*
ULNB & SCR	96	Combining both removal Effs; **ULNB** for LNB
ULNB & SNCR	53	Combining both removal Effs; **ULNB** for LNB
SCR	85	Based on Unit 1332 Performance
ULNB	76	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	NA	**Neither LNB nor FGR is used on heaters in USA today**
CT	10	Minimial to gain here
LNB	15	Would not install vs ULNB

Nox Control Cost Effectiveness at Max Cpacity

Source 11H1 Heater at Unit 865

Evaluated at New Firing Limit but at 1999 Cost and Efficiencies

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	1999 Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Incr. Shdn. Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
LNB & SCR	**87.3**	0.113	43.2	NA	88	5.2	38.0	0	0	0	-	-
LNB & SNCR	**87.3**	0.113	43.2	NA	80	8.6	34.6	1403391	33858	0	282,258	8,166
SCR	**87.3**	0.113	43.2	NA	**85**	6.5	36.7	0	0	0	-	-
ULNB	**87.3**	0.113	43.2	NA	56	19.0	24.2	206707	12000	0	48,587	2,008
SNCR	**87.3**	0.113	43.2	NA	60	17.3	25.9	1222518	25858	0	242,244	9,344
LNB & FGR	**87.3**	0.113	43.2	NA	55	19.4	23.8	0	0	0	-	-
LNB	**87.3**	0.113	43.2	NA	27	31.5	11.7	180873	8000	0	40,015	3,430
CT	**87.3**	0.113	43.2	NA	15	36.7	6.5	0	7000	0	7,000	1,080
		Current All Gas			Adj SCR to Realistic							

SCR and FGR do not physically fit the plot space and are therefore infeasible

Nox Control Cost Effectiveness at Max Cpacity
Source 11H1 Heater at Unit 865

Evaluated at New Firing Limit but at 1999 Cost and 2012 Efficiencies

Most Stringent Case

Control Option	New Rating MM Btu/Hr Maximum	Current Emis Rate #/MM Btu	Max Poten Baseline Emis Rate tpy Gas	Oil	**2012** Cont Eff % on Gas	Max Pot Post Con Emis Rate tpy	PTE Nox Red'n tpy	1999 Total Capital Cost $	1999 O & M Cost $	1999 Incr. Shdn. Cost $	1999 Annualized Cost $	1999 PTE Avg. Cost Effectiveness $/Ton
ULNB & SCR	**87.3**	0.113	43.2	NA	**96**	1.7	41.5	0	0	0	-	-
ULNB & SNCR	**87.3**	0.113	43.2	NA	**80**	8.6	34.6	1403391	33858	0	282,258	8,166
SCR	**87.3**	0.113	43.2	NA	**85**	6.5	36.7	0	0	0	-	-
ULNB	**87.3**	0.113	43.2	NA	**74**	11.2	32.0	206707	12000	0	48,587	1,520
SNCR	**87.3**	0.113	43.2	NA	**60**	17.3	25.9	1222518	25858	0	242,244	9,344
LNB & FGR	**87.3**	0.113	43.2	NA	**55**	19.4	23.8	0	0	0	-	-
LNB	**87.3**	0.113	43.2	NA	**27**	31.5	11.7	180873	8000	0	40,015	3,430
CT	**87.3**	0.113	43.2	NA	**15**	36.7	6.5	0	7000	0	7,000	1,080
		Current All Gas		None in 1999	Adj SCR to Realistic							

SCR and FGR do not physically fit the plot space and are therefore infeasible

Source	*2012 Eff.*	*Comment*
ULNB & SCR	96	Combining both removal Effs; **ULNB** for LNB
ULNB & SNCR	53	Combining both removal Effs; **ULNB** for LNB
SCR	85	Based on Unit 1332 Performance; **does not physically fit this plot space**
ULNB	74	Based on Vendors and experience 0.03 #/MM Btu
SNCR	40	Heater Stack Temps below 700°F result in low NOX removal Eff
LNB & FGR	NA	**Neither LNB nor FGR is used on heaters in USA today; do not physically fit this plot anyway**
CT	10	Minimial to gain here
LNB	15	Would not install vs ULNB